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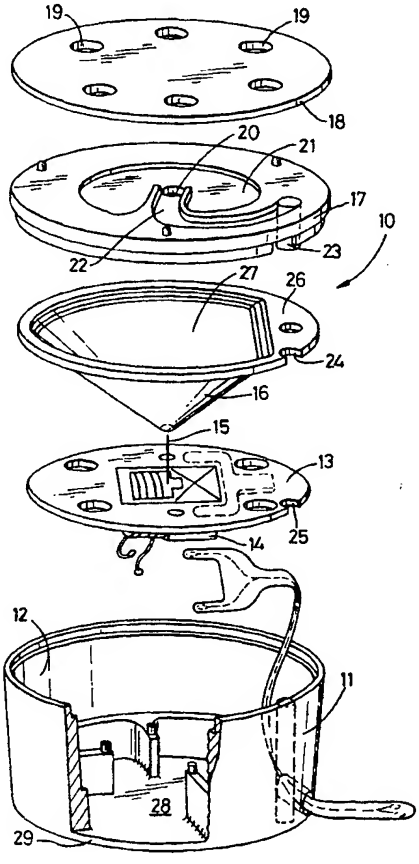
(54) Title: AN ELECTRO-ACOUSTIC TRANSDUCER

(57) Abstract

This invention relates to electro-acoustic transducers such as is generally indicated at (10) and which comprise a body (11) defining a chamber (12), a plate (13) bearing a microphone or speaker (14) to which is attached a stalk (15), a diaphragm (16), connectable to the stalk (15), which extends substantially across the chamber (12), an end piece (17) and an end cap (18). The end piece (17) has a kidney-shaped recess (21) which provides the main communication path between subsidiary inlets/outlets (19) and a main inlet/outlet (20). When the channel (22) is closed off by the end cap (18) it is effectively in the form of a tube and constitutes a Thuras tube. The length of this path effectively creates a long discharge path between the wearer's ear and any earthable metal part within the transducer and hence protects against electric shock.



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AN ELECTRO-ACOUSTIC TRANSDUCER

This invention relates to electro-acoustic transducers and particularly, but not exclusively, to such transducers in the form of earpieces for telephone headsets and the like.

Telephone operators often build up very substantial static voltages on their bodies, particularly if they are imprudent enough to wear man-made fibres. If they then plug their headset into the telephone exchange apparatus it is not uncommon for a spark to jump from their ear through the acoustic inlets in the earpiece to an earthed metal portion of the transducer. As these sparks can be derived from several thousands of volts the sensation is at best uncomfortable. This problem particularly arises in small devices where the distances between the acoustic inlets and earthable portions of transducers are normally extremely small. Additionally, it has been found difficult to produce economically and compactly a suitable method of boosting the bass response of such earpieces.

The object of the invention is to mitigate one or both of these problems.

From one aspect the invention consists in an electro-acoustic transducer including a body defining a chamber, a diaphragm extending across at least part of the chamber to define front and rear portions, a main acoustic inlet/outlet connected to the front portion and a Thuras tube connecting

the rear portion and the main inlet/outlet wherein at least a portion of the tube is defined by an end piece forming a wall of the chamber.

In a preferred embodiment the end piece further defines the main acoustic inlet/outlet and the tube may be formed as a channel in that end piece. Particularly conveniently the transducer may further include a cap overlying the end piece with subsidiary inlet/outlets formed therein and offset from the main inlet/outlet. In this case the end cap may close off the channel to complete the tube.

The end cap and end piece may together define an extended air path between the subsidiary inlet/outlets and an earthable metal part within the chamber. Current designs simply have these inlets and outlets passing straight through the cap into the chamber, although sometimes there are guards to prevent mechanical damage due to penetration through these holes.

From another aspect there is provided an electro-acoustic transducer having a chamber including an earthable metal part, a non-electrically conducting cover defining a number of subsidiary acoustic inlet/outlets and a main acoustic inlet/outlet for the chamber wherein the cover defines an extended air path between the subsidiary outlets and an earthable metal part within.

As has been mentioned above this extended path reduces the risk of electrical discharge occurring along the path typically for potential differences of up to 15,000 volts D.C.

Preferably the chamber is generally cylindrical, the main inlet/outlet is at or adjacent the axis of the chamber, the subsidiary inlets/outlets are radially offset therefrom and the main inlet/outlet is defined in the wall extending across the chamber.

Particularly conveniently the subsidiary inlets/outlets are formed in an end cap which overlies the wall and a part of the air path is defined between the air cap and the wall.

Although the invention has been defined it is to be understood it includes any inventive combination of the features set out above or in the following description.

The invention may be performed in various ways and a specific embodiment will now be described, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 is an exploded view of an electro-acoustic transducer;

Figure 2 is a more detailed view from above of an end piece of the transducer, and

Figure 3 is a diagrammatic cross-sectional view of the upper part of the transducer demonstrating a discharge path.

An electro-acoustic transducer is generally indicated at 10 and comprises a body 11, defining a chamber 12, a plate 13 bearing a microphone or speaker 14 to which is attached a stalk 15, a diaphragm 16, connectable to the stalk 15, which extends substantially across the chamber 12, an end piece 17 and an end cap 18.

The end cap 18 defines a number of spaced subsidiary

acoustic inlets/outlets 19, through which sound may pass either to or from a main acoustic inlet/outlet 20 defined in the end cap 18. This inlet/outlet 20 communicates directly with the diaphragm 16 and hence via the stalk 15, with the microphone 14.

It will be noted that the end piece 17 has a kidney-shaped recess 21, which provides the main communication path between the subsidiary inlets/outlets and the main inlet/outlet 20. A channel 22 projects into this recess 21 to extend from the main inlet/outlet 20 to a vertical shaft 23 which extends through the thickness of the end cap 18 to communicate with aligned notches 24,25 in the diaphragm support 26 and the plate 13.

It will thus be seen that the main inlet/outlet 20 communicates both with a front portion 27 of the chamber 12 contained within the diaphragm 16 and a rear portion 28 defined between the base 29 of the body 11 and the plate 13. As the end cap 18 is shaped so that it closes off the upper mouth of the channel 22, the channel 22 is effectively in the form of a tube and constitutes a Thuras tube providing bass resonance or reinforcement from the rear portion 28 of the chamber 12.

This construction is particularly compact; economic to make and easy to assemble.

As has been mentioned above, many traditional earpieces for headsets, and indeed other transducers, have the sound inlets passing simply through the end cap 18 and the end piece 17 does not exist. This means that there is a very

short discharge path between a wearer's ear and any earthable metal part within the transducer, such as the diaphragm support 26.

Referring to Figure 3, it will be seen that the interposing of the end piece 17 and the provision of a central main acoustic inlet/outlet, has the effect of making a considerably extended air path between the ear (here represented as an electrode 30) and the metal part 31. The result is that very high voltages, say typically 14,000 or 15,000 volts D.C. have to be built up before a spark will jump along a path of this length. Clearly, in order for this aspect of the invention to operate, the end piece 17 and end cap 18 must be electrically insulating.

It will be appreciated that the provision of both of the extended air path and the Thuras tube in the end piece/end cap combination is particularly effective in producing a much improved transducer at low additional cost.

Although these advantages have been particularly demonstrated in connection with earpieces, they are equally applicable to any transducer use in which large D.C. voltages are likely to occur adjacent the sound inlet/outlets.

Claims

1. An electro-acoustic transducer including a body defining a chamber, a diaphragm extending across at least part of the chamber to define front and rear portions, a main acoustic inlet/outlet connected to the front portion and a Thuras tube connecting the rear portion and the main inlet/outlet, wherein at least a portion of the tube is defined by an end piece forming a wall of the chamber.

2. A transducer, wherein in the end piece further defines the main acoustic inlet/outlet.

3. A transducer as claimed in Claim 1 or Claim 2, wherein the tube Thuras is in the form of a channel formed in the end piece.

4. A transducer as claimed in any one of Claims 1 to 3, further including a cap overlying the end piece with subsidiary inlets/outlets formed therein offset from the main inlet/outlet.

5. A transducer as claimed in Claim 4 as dependent on Claim 3, wherein the end cap closes off the channel to form the Thuras.

6. A transducer as claimed in Claim 4 and Claim 5, wherein the end cap and end piece together define an extended air path between the subsidiary inlet/outlet and an earthable metal part within the chamber.

7. An electro-acoustic transducer having a chamber including an earthable metal part therein, a non-electrically conducting cover defining a number of subsidiary acoustic inlets/outlets and a main acoustic inlet/outlet for the

chamber, wherein the cover defines an extended air path between the subsidiary outlets and the earthable metal part.

8. A transducer as claimed in Claim 7, wherein the chamber is generally cylindrical, the main inlet/outlet is at or adjacent the axis of the chamber; the subsidiary inlets/outlets are radially offset therefrom and the main inlet/outlet is defined in a wall extending across the chamber.

9. A transducer as claimed in Claim 8, wherein the subsidiary inlets/outlets are formed in an end cap which overlies the wall and a part of the air path is defined between the air cap and the wall.

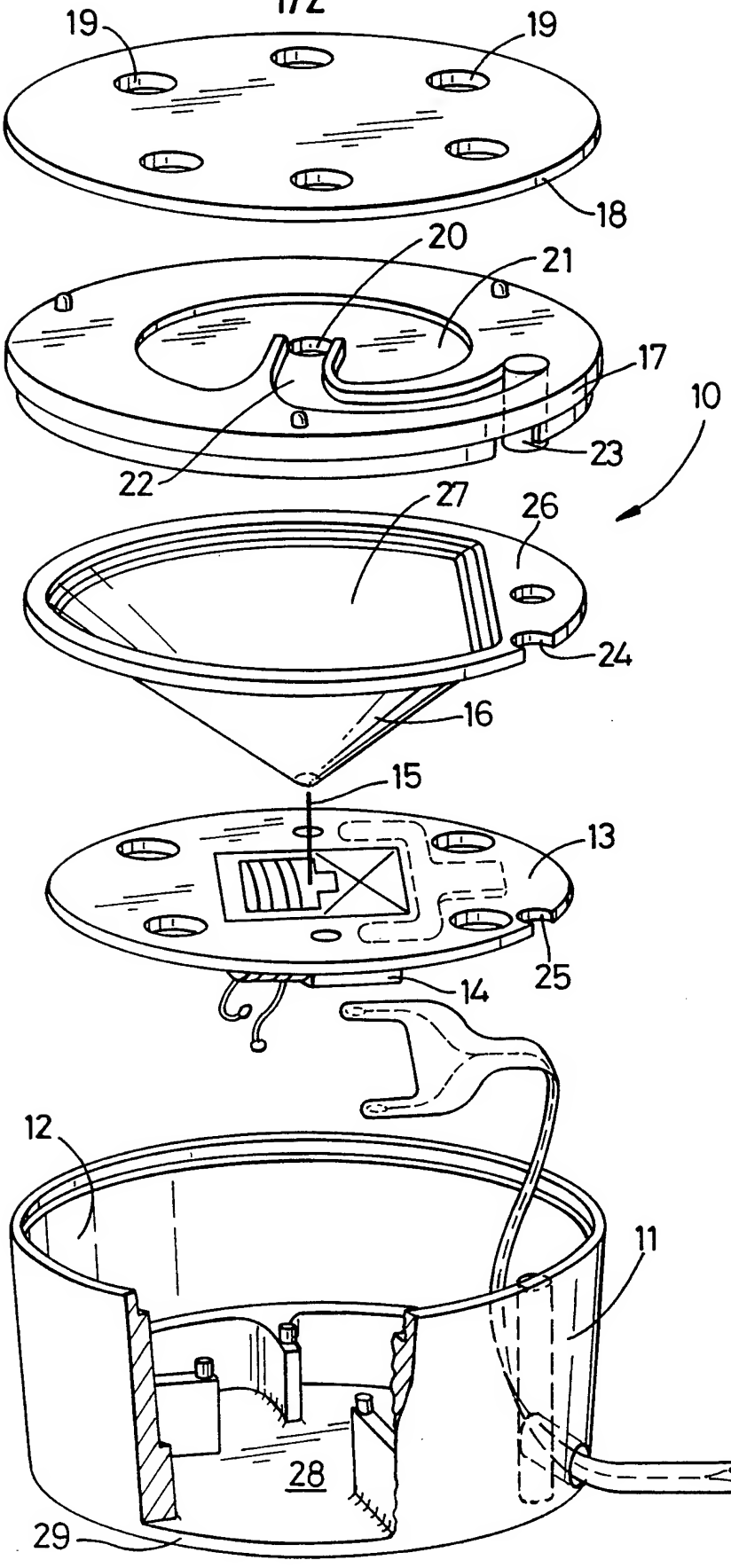

Fig. 1

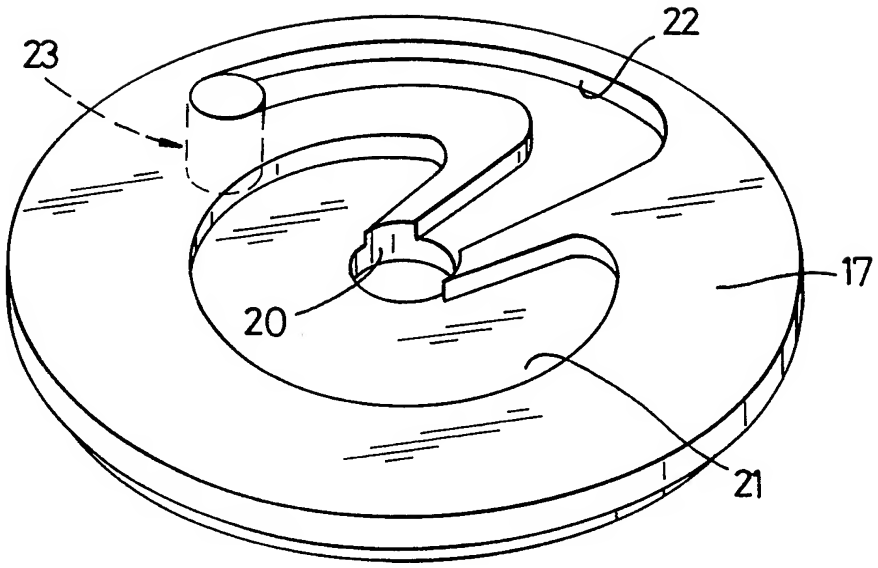

Fig. 2

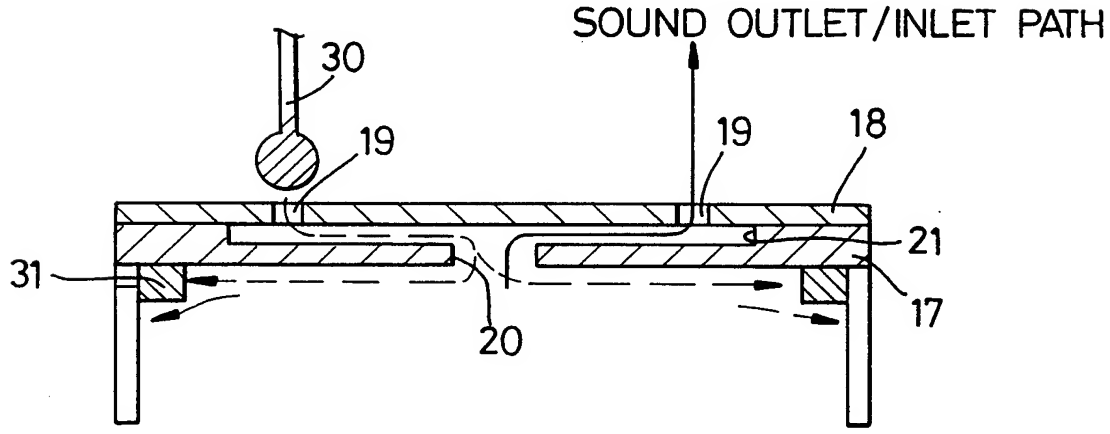

Fig. 3

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 93/02457

A. CLASSIFICATION OF SUBJECT MATTER

H 04 R 9/10,H 04 R 11/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H 04 R 1/00,H 04 R 9/00,H 04 R 11/00,H 04 R 13/00,
H 04 R 23/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP, A1, 0 074 818 (A.P. BESSON LTD.) 23 March 1983 (23.03.83), the whole document. --	1
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☐ Further documents are listed in the continuation of box C.

☐ Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
28 February 1994	18. 04. 94

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ANHANG

zum internationalen Recherchenbericht über die internationale Patentanmeldung Nr.

ANNEX

to the International Search Report to the International Patent Application No.

ANNEXE

au rapport de recherche international relatif à la demande de brevet international n°

PCT/GB 93/02457 SAE 82369

In diesem Anhang sind die Mitglieder der Patentfamilien der im obengenannten internationalen Recherchenbericht angeführten Patentdokumente angegeben. Diese Angaben dienen nur zur Unterrichtung und erfolgen ohne Gewähr.

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